

## REMARKS

Claims 1-15 and 17-43 are pending in the application. Claims 15, 22, 31 and 35 have been amended to more clearly recite the Applicants' invention. Claim 16 has been cancelled without prejudice.

### Applicant's Invention

The present invention relates generally to cross module representation of a heterogeneous program. A heterogeneous program is an executable program having components in different forms. A primary motivation for the present invention is the ability to translate and transform an executable heterogeneous program into other platform(s) without resorting to the original source code from which the executable was derived. The resulting translated or transformed program, likewise, may be heterogeneous; i.e., have components in different forms.

### Cited References

As to claim rejections under 35 U.S.C. §102 and 35 U.S.C. § 103, the Office Action relies on Patent Nos. 5,966,539 and 5,539,907 by Amitabh Srivastava et al. (the '539 patent and the '907 patent, respectively). In contrast to the present invention, neither the '539 system nor the '907 system operate on a heterogeneous program. The '539 patent discloses a system for organizing procedures among a set of object modules, which are not heterogeneous. The '539 system does not translate the object modules into a heterogeneous program. Rather, the '539 system converts linked code into machine executable code compatible with a target one of a plurality of computer system hardware architectures. (See '539, Abstract). As such, the '539 system does not solve the problems that are solved with the present invention.

The '907 patent discloses a system for monitoring computer system performance. The system includes translating a collection of object modules into a linked code module that is subsequently converted to machine executable code for one computer platform. (See '907, Summary). The system in '907 does not perform operations on a heterogeneous program as is described in the present application.

### **Rejections of claims 19-30 under 35 U.S.C. § 101**

The Examiner rejected claims 19-30 as being unpatentable under 35 U.S.C. § 101 as being directed to a data structure, *per se*. The Applicant traverses this rejection.

The Applicant respectfully submits that claims 19-30 do not recite a data structure *per se*. Analogous to the claims of *In re Lowry*, 32 U.S.P.Q.2d 1031 (C.A.F.C. 1994), claim 19 recites stored data that exists as a collection of bits having information about the relationships between an opcode for an intermediate representation instruction, operands related to the opcode, a size related to the opcode instruction and the operands, and a mode representing an addressing mode for the opcode instruction. The data structure imparts a physical organization of the data therein. The data structure thereby facilitates computerized modeling of intermediate representation instructions and translation and transformation of heterogeneous programs using the data structure.

With regard to claims 25-30, claims 25-30 recite a hierarchical data structure for an intermediate representation of a heterogeneous program having a component data structure for a component in the heterogeneous program having a pointer to a procedure data structure associated with a procedure in the component, the procedure data structure having a pointer to a code block in the procedure, and an instruction data structure having a pointer to an instruction in the code block. As such, the data structure imparts a physical organization to data in computer memory for modeling an intermediate representation of a heterogeneous program.

Moreover, claims 19-24 are not recited in the abstract. *See id.* Instead, claims 19-24 recite a computer-readable medium storing an opcode field containing data representing an opcode for an intermediate representation, operand fields containing data representing operands for the opcode, a size field having data representing a length of an instruction associated with the opcode and the operands, and a mode field having data representing an addressing mode for the instruction. By virtue of the data contained in the data structure, an opcode, operands, length, and addressing mode is associated with an intermediate representation instruction, thereby describing an interrelationship between an opcode and an instruction in an intermediate representation, used by system for translating a heterogeneous program. Accordingly, the Applicant asserts that claims 19-24 are patentable subject matter under 35 U.S.C. §101 and *In re Lowry*.

Nor are claims 25-30 recited in the abstract. *See id.* Rather, claims 25-30 recite a computer-readable medium storing a hierarchical data structure for an intermediate representation of a heterogeneous program having a component data structure with a procedure field having a pointer to a procedure data structure related to a procedure in the component, the procedure data structure having a pointer to a code block in the procedure, and an instruction data structure having a pointer to an instruction in the code block. The component data structure, the procedure data structure, and the instruction data structure are interrelated in the hierarchical data structure to model an intermediate representation of the heterogeneous program.

In addition, the "Examination Guidelines for Computer-Related Inventions" (referred to hereinafter as the "Guidelines") issued by the U.S. Patent and Trademark Office, while not binding law, also support the invention recited by claims 19-30 as patentable subject matter. Data structures *per se* are deemed unpatentable subject matter under Section IV.A.1.(a) of the Guidelines:

Data structures not claimed as embodied in computer-readable media are descriptive material *per se* and are not statutory because they are neither physical "things" nor statutory processes. Such claimed data structures do not define any structural and functional interrelationships between the data structure and other claimed aspects of the invention which permit the data structure's functionality to be realized.

However, the same paragraph of the Guidelines goes on to contrast a computer-readable medium encoded with a data structure:

In contrast, a claimed computer-readable medium encoded with a data structure defines structural and functional interrelationships between the data structure and the medium which permit the data structure's functionality to be realized, and is thus statutory.

The Applicant respectfully submits that claim 19 recites a "computer-readable medium having stored thereon an intermediate representation instruction data structure" and is thus statutory. Because claims 20-24 depend from claim 19 and, therefore, include all the limitations of claim 19, claims 20-24 are also believed to be statutory. Accordingly, the Applicant earnestly requests withdrawal of the rejection of claims 19-24 under 35 U.S.C. § 101.

Claim 24 recites a "computer-readable medium having stored thereon a hierarchical data structure for an intermediate representation of a heterogeneous program" and is thus statutory.

Because claims 25-30 depend from claim 24 and, therefore, include all the limitations of claim 24, claims 25-30 are also believed to be statutory. Accordingly, the Applicant earnestly requests withdrawal of the rejection of claims 25-30 under 35 U.S.C. § 101.

**Rejections of claims 1, 2, 6-9, 11-13, 15-18, 31-35, and 39-41 under 35 U.S.C. § 102(e)**

The Examiner rejected claims 1, 2, 6-9, 11-13, 15-18, 31-35, and 39-41 under 35 U.S.C. § 102(e) based on the '539 patent. For a claim to be anticipated, every claim element must be disclosed in the cited reference. See MPEP 2131. The Applicant respectfully traverses these rejections because the '539 patent neither discloses nor suggests all the claim elements of any of the claims 1, 2, 6-9, 11-13, 15-18, 31-35, and 39-41 of the present application.

**Rejections of claims 1, 2, 6-9, 11-13, and 41**

Claim 1 recites a computerized method for translating and transforming a heterogeneous program including, in part, obtaining a binary for a component in the heterogeneous program. Claim 41 recites iterating an intermediate representation of a heterogeneous program through a computerized system to create a plurality of new version of the heterogeneous program. As discussed in the specification, a heterogeneous program consists of components in different forms. (See Application, p. 2, lines 6-7). Exemplary forms of components in a heterogeneous program are Intel x86 binary, Intel IA-64, Visual Basic byte codes, Java class files, or Virtual Machine binaries.

The cited reference '539 neither teaches nor suggests obtaining a binary of a component in a heterogeneous program. The '539 patent does not recite iterating an intermediate representation of a heterogeneous program. Indeed, the '539 patent does not mention a heterogeneous program at all. Therefore, the '539 patent does not disclose obtaining a binary of a component in a heterogeneous program or iterating an intermediate representation of a heterogeneous program.

Furthermore, there is no motivation in the '539 patent for transformation of heterogeneous programs. In fact, the '529 patent teaches away from transformation of a heterogeneous program. The '539 patent discloses a system that converts linked code into machine executable code compatible with a target one of a plurality of computer system hardware architectures. (See '539, Abstract). As described in the '539 patent, the linked code 52 is created from a collection of

object modules 40 and optional library modules 49. (See '539, Col. 4, lines 41-44). Therefore, the optimizer 50 of the '539 patent operates on all the object modules 40 to create one executable code 60' for a particular platform (i.e., not heterogeneous). (See '539, Col. 4, lines 41-44, Col. 5, lines 20-21). Therefore, the '539 patent fails to teach or suggest all of the claim elements of claims 1 and 41.

For at least these reasons, claims 1 and 41 are believed to be allowable over the art of reference. Because claims 2, 6-9, and 11-13 depend from claim 1 and, therefore, include all the limitations of claim 1, claims 2, 6-9, and 11-13 are also believed to be allowable over the art of reference. Accordingly, the Applicant earnestly requests withdrawal of the rejection of claims 1, 2, 6-9, 11-13, and 41 under 35 U.S.C. § 102(e).

#### Rejections of claims 15-18

Claim 15 has been amended to include the limitations of claim 16, which has been cancelled. As amended, claim 15 recites a computer-readable medium having computer-executable instructions to cause a computer to perform a reader method including, in part, obtaining a binary for a component contained in a heterogeneous program. As amended, claim 15 is believed to be allowable over the art of reference for at least the same reasons given for claim 1. Because claims 17-18 depend from claim 15 and, therefore, include all the limitations of claim 15, claims 17-18 are also believed to be allowable over the art of reference. Accordingly, the Applicant earnestly requests withdrawal of the rejection of claims 15, 17, and 18 under 35 U.S.C. § 102(e).

#### Rejections of claims 31-35 and 39-40

Independent claims 31 and 35 have been amended to include translating a platform-specific binary corresponding to a component in a heterogeneous program. As amended, claims 31 and 35 are believed to be allowable over the art of reference for at least the same reasons given for claim 1. Because claims 32-34 depend from claim 31 and, therefore, include all the limitations of claim 31, claims 32-34 are also believed to be allowable over the art of reference. Because claims 39-40 depend from claim 35 and, therefore, include all the limitations of claim 35, claims 39-40 are also believed to be allowable over the art of reference. Accordingly, the

Applicant earnestly requests withdrawal of the rejection of claims 31-35 and 39-40 under 35 U.S.C. § 102(e).

**Rejections of claims 3-5, 10, 14, 36-38, 42, 43 under 35 U.S.C. § 103(a)**

The Examiner rejected claims 3-5, 10, 14, 36-38, 42, and 43 under 35 U.S.C. § 103(a) as being obvious in light of the '539 patent. In order for claims to be obvious in light of a reference, there must be some suggestion or motivation to modify the reference, there must be a reasonable expectation of success, and the prior art reference must teach or suggest all the claim limitations. (See MPEP § 2143). Applicants respectfully traverse the Examiner's obviousness rejections.

Claims 3-5, 10, and 14 depend from claim 1 and, therefore, include all the limitations of claim 35. As discussed herein with respect to claim 1, the art of record neither teaches nor suggests all of the limitations in claim 1. Therefore, the art of record neither teaches nor suggests all the claim limitations of claims 3-5, 10, and 14. As such, the Applicants believe claims 3-5, 10, and 14 are allowable over the art of record. Allowance of claims 3-5, 10, and 14 is earnestly requested.

Claims 36-38 depend from claim 35 and, therefore, include all the limitations of claim 35. As discussed herein with respect to claim 35, the art of record neither teaches nor suggests all of the limitations in claim 35. Therefore, the art of record neither teaches nor suggests all the claim limitations of claims 36-38. As such, the Applicant believes claims 36-38 are allowable over the art of record. Allowance of claims 36-38 is earnestly requested.

Claims 42-43 depend from claim 41 and, therefore, include all the limitations of claim 41. As discussed herein with respect to claim 41, the art of record neither teaches nor suggests all of the limitations in claim 41. Therefore, the art of record neither teaches nor suggests all the claim limitations of claims 42-43. As such, the Applicant believes claims 42-43 are allowable over the art of record. Allowance of claims 42-43 is earnestly requested.

**Conclusion**

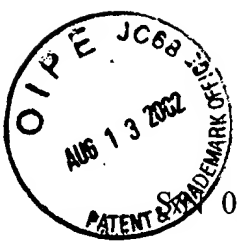
This amendment is believed to be responsive to all points raised in the Office Action. Claims 1-15 and 17-43 remain pending in the application and are believed to clearly be allowable over the art of record. Accordingly, prompt allowance and passage of the application to issue are earnestly solicited. A separate markup with the claim amendments shown by bracketing and underlining is enclosed with this amendment in accordance with 37 C.F.R. 1.121. Should the Examiner have any remaining questions or concerns, he is encouraged to contact the undersigned attorney by telephone to expeditiously resolve such concerns.

Respectfully submitted,

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PATENT

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant:	Chaiken et al.	Examiner:	Steelman, Mary J.
Serial No.:	09/343,805	Group Art Unit:	2122
Filed:	June 30, 1999	Docket No.:	124240.1 M&G60001.57US01
Title:	TRANSLATION AND TRANSFORMATION OF HETEROGENEOUS PROGRAMS		

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**AMENDMENTS -- MARKUP**

Claims

15. (Once Amended) A computer-readable medium having computer-executable instructions to  
[a] cause a computer to perform a reader method comprising:

obtaining a binary for a component contained in a heterogeneous program;  
analyzing the binary; [and]  
building an intermediate representation for the component[.]; and  
building an intermediate representation of [a] the heterogeneous program containing the  
component.

22. (Once Amended) The computer-readable medium of claim 19, further comprising:

a destination operand type field containing data representing a type for the destination  
operand identified by the destination operand field;  
a first source operand type field containing data representing a type for the [a] first source  
operand identified by the [a] first source operand field; and  
a second source operand type field containing data representing a type for the second  
source operand identified by the [a] second source operand field.

31. (Once Amended) A computerized system comprising:

a processing unit;  
a system memory coupled to the processing unit through a system bus;



a computer-readable medium coupled to the processing unit through a system bus; and  
a translation and transformation system executed from the computer-readable medium  
by the processing unit, wherein translation and transformation system causes the processing unit  
to translate a platform-specific binary corresponding to a component in a heterogeneous program,  
into a plurality of intermediate representation instructions.

35. (Once Amended) A computer-readable medium having computer-executable instructions  
stored thereon for performing a method of transforming a heterogeneous program comprising:  
translating a platform-specific binary corresponding to a component in the heterogeneous  
program, into a plurality of intermediate representation instructions.